

WHAT CLAIMED IS:

1. A high-isolated wavelength managing module, having a first, a second, a third and a fourth ports, comprising:

5 a plurality of wavelength managing modules, wherein one port of one of the wavelength managing modules connected to the first port of the high-isolated wavelength managing module for receiving and carrying first optical signals with different wavelengths, and one port of another wavelength managing module connected to the fourth port of the high-isolated wavelength managing module for receiving and carrying second optical signals with different wavelengths, the first and the second
10 optical signals are transmitted in opposite direction and with different wavelengths; and a plurality of optical circulators, optically coupled among the wavelength managing modules.

2. The high-isolated wavelength managing module of claim 1, wherein the wavelength managing modules comprise a first, a second and a third wavelength
15 managing modules, and the optical circulators comprise a first and a second optical circulators.

3. The high-isolated wavelength managing module of claim 2, wherein the first wavelength managing module is coupled to the first port of the high-isolated wavelength managing module, the second wavelength managing module is coupled to
20 the fourth port of the high-isolated wavelength managing module, the first optical circulator is coupled between the first and the third wavelength managing modules, and the second optical circulator is coupled between the second and the third wavelength managing modules.

4. The high-isolated wavelength managing module of claim 3, wherein each of the

first, the second and the third wavelength managing modules comprises four ports, and

the first port of the first wavelength managing module is connected to the first port of the high-isolated wavelength managing module;

the first port of the second wavelength managing module is connected to the fourth
5 port of the high-isolated wavelength managing module; and

the second port of the third wavelength managing module is connected to the second port of the high-isolated wavelength managing module, and

the third port of the third wavelength managing module is connected to the third port of the high-isolated wavelength managing module.

10 5. The high-isolated wavelength managing module of claim 4, wherein each of the optical circulators comprises at least three ports, and

the first port of the first optical circulator is connected to the second port of the first wavelength managing module;

the second port of the first optical circulator is connected to the first port of the
15 third wavelength managing module;

the third port of the first optical circulator is connected to the third port of the first wavelength managing module, and

the first port of the second optical circulator is connected to the third port of the second wavelength managing module;

20 the second port of the second optical circulator is connected to the fourth port of the third wavelength managing module; and

the third port of the first optical circulator is connected to the second port of the second wavelength managing module.

6. The high-isolated wavelength managing module of claim 2, further comprising:

a first optical adding and dropping multiplexer coupled between the first wavelength managing module and the first optical circulator; and

a second optical adding and dropping multiplexer coupled between the second wavelength managing module and the second optical circulator.

5 7. The high-isolated wavelength managing module of claim 2, wherein the first and the second optical signals respectively pass through the first wavelength managing module once, the third wavelength managing module twice, the second wavelength managing module once, the first optical circulator once and the second optical circulator once.

10 8. The high-isolated wavelength managing module of claim 2, further comprising:
a first wavelength crossconnect coupled between the first wavelength managing module and the first optical circulator; and

a second wavelength crossconnect coupled between the second wavelength managing module and the second optical circulator.

15 9. The high-isolated wavelength managing module of claim 2, further comprising an optical gain module coupled between the second and the third ports of the third wavelength managing module by optical transmission lines to form a high-isolated bi-directional optical function module.

20 10. The high-isolated wavelength managing module of claim 2, further comprising a three-port optical circulator and at least one optical fiber grating, wherein the three-port optical circulator and the optical fiber grating coupled between the second and the third ports of the third wavelength managing module by optical transmission lines to form a high-isolated bi-directional optical function module.

11. The high-isolated wavelength managing module of claim 9, wherein the optical

gain module further comprises an optical fiber doped with a rare-earth element, at least one light source, a first and a second optical fiber isolator.

12. The high-isolated wavelength managing module of claim 1, wherein the wavelength managing modules comprise a first and a second wavelength managing modules, and the optical circulators comprise a first and a second optical circulators.

13. The high-isolated wavelength managing module of claim 12, wherein the first wavelength managing module is coupled to the first port of the high-isolated wavelength managing module, the second wavelength managing module is coupled to the fourth port of the high-isolated wavelength managing module, the first optical circulator is coupled to the first wavelength managing module, and the second optical circulator is coupled to the second wavelength managing modules and in turn to the first optical circulator, thereby the first wavelength managing module, the first optical circulator, the second optical circulator, and the second wavelength managing module form an optical transmission channel.

14. The high-isolated wavelength managing module of claim 13, wherein each of the first and the second wavelength managing modules comprises four ports, and

the first port of the first wavelength managing module is connected to the first port of the high-isolated wavelength managing module and the fourth port of the second wavelength managing module is connected to the fourth port of the high-isolated wavelength managing module.

15. The high-isolated wavelength managing module of claim 14, wherein each of the first and the second optical circulators comprises at least three ports, and

the first port of the first optical circulator is connected to the second port of the first wavelength managing module,

the second port of the first optical circulator is connected to the second port of the first optical circulator,

the third port of the first optical circulator is connected to the third port of the first wavelength managing module; and

5 the first port of the second optical circulator is connected to the second port of the second wavelength managing module,

the second port of the second optical circulator is connected to the second port of the first optical circulator,

10 the third port of the second optical circulator is connected to the third port of the second wavelength managing module.

16. The high-isolated wavelength managing module of claim 13, further comprising:

a first optical adding and dropping multiplexer coupled between the first wavelength managing module and the first optical circulator; and

15 a second optical adding and dropping multiplexer coupled between the second wavelength managing module and the second optical circulator.

17. The high-isolated wavelength managing module of claim 13, further comprising:

20 a first wavelength crossconnect coupled between the first wavelength managing module and the first optical circulator; and

a second wavelength crossconnect coupled between the second wavelength managing module and the second optical circulator.

18. A high-isolated bi-directional optical function module, for automatically exchanging optical signals, comprising:

at least one high-isolated wavelength managing module, wherein the first port of the high-isolated wavelength managing module receives and carries first optical signals with different wavelengths, and the fourth port of the high-isolated wavelength managing module receives and carries second optical signals with different wavelengths, the first and the second optical signals are transmitted in opposite direction and with different wavelengths;

a set of optical transmission lines coupled between the first and the fourth ports of the high-isolated wavelength managing module; and

at least one uni-directional optical function module with an isolation capability, coupled between the second and the third ports of the high-isolated wavelength managing module.

19. The high-isolated bi-directional optical function module of claim 18, wherein the uni-directional optical function module with an isolation capability comprises an optical gain module, coupled between the second and the third ports of the high-isolated wavelength managing module.

20. The high-isolated bi-directional optical function module of claim 19, wherein the optical gain module further comprises an optical fiber doped with a rare-earth element, at least one light source, a first and a second optical fiber isolator.

21. The high-isolated bi-directional optical function module of claim 18, wherein the uni-directional optical function module with an isolation capability comprises a chromatic dispersion compensator, coupled between the second and the third ports of the high-isolated wavelength managing module.

22. The high-isolated bi-directional optical function module of claim 21, wherein the chromatic dispersion compensator further comprises an optical fiber grating.

23. The high-isolated bi-directional optical function module of claim 21, wherein the chromatic dispersion compensator further comprises at least one three-port optical circulator and an optical fiber grating.

24. A high-isolated bi-directional optical function module, for automatically
5 exchanging optical signals, comprising:

at least one high-isolated wavelength managing module, the high-isolated wavelength managing module having four ports, wherein the first port of the high-isolated wavelength managing module receives and carries first optical signals with different wavelengths, and the fourth port of the high-isolated wavelength managing
10 module receives and carries second optical signals with different wavelengths, the first and the second optical signals are transmitted in opposite direction and with different wavelengths;

a set of optical transmission lines coupled between the first and the fourth ports of the high-isolated wavelength managing module;

15 at least one uni-directional optical function module, coupled between the second and the third ports of the high-isolated wavelength managing module; and

at least one optical isolator, optically coupled between the uni-directional optical function module and the third port of the high-isolated wavelength managing module.

25. A high-isolated bi-directional optical function system, for automatically
20 exchanging optical signals, comprising:

a plurality of high-isolated wavelength managing modules, wherein the first port of the high-isolated wavelength managing module receives and carries first optical signals with different wavelengths, and the fourth port of the high-isolated wavelength managing module receives and carries second optical signals with different wavelengths,

the first and the second optical signals are transmitted in opposite direction and with different wavelengths;

at least one uni-directional wavelength crossconnect having a plurality of input ports and a plurality of output ports, each of the input and output ports being
5 respectively coupled to the each second and third ports of the high-isolated wavelength managing modules; and

a plurality of optical isolators, optically coupled between the uni-directional wavelength crossconnect and each third port of the corresponding high-isolated wavelength managing module.

10 26. The high-isolated bi-directional optical function system of claim 25, wherein the number of the high-isolated wavelength managing modules is consistent with input optical transmission lines of the high-isolated bi-directional optical function system.

27. The high-isolated bi-directional optical function system of claim 25, wherein the number of the optical isolators is consistent with the input optical transmission lines
15 of the high-isolated bi-directional optical function system.

28. A high-isolated wavelength managing module, having a first, a second, a third and a fourth ports, comprising:

a plurality of wavelength managing modules with self-loops, wherein one port of one of the wavelength managing modules with self-loops connected to the first port of
20 the high-isolated wavelength managing module for receiving and carrying first optical signals with different wavelengths, and one port of another wavelength managing module with self-loops connected to the fourth port of the high-isolated wavelength managing module for receiving and carrying second optical signals with different wavelengths, the first and the second optical signals are transmitted in opposite

direction and with different wavelengths; and

a wavelength managing module without self-loops, coupled between the wavelength managing modules with self-loops.

29. The high-isolated wavelength managing module of claim 28, wherein the
5 wavelength managing modules with self-loops comprise a first and a second wavelength managing modules with self-loops.

30. The high-isolated wavelength managing module of claim 28, wherein the first
wavelength managing module with self-loops is coupled to the first port of the high-
isolated wavelength managing module, the second wavelength managing module with
10 self-loops is coupled to the fourth port of the high-isolated wavelength managing module, and the wavelength managing module without self-loops is coupled between the first and the second wavelength managing modules with self-loops.

31. The high-isolated wavelength managing module of claim 30, wherein each of
the first and the second wavelength managing modules with self-loops and the
15 wavelength managing module without self-loops comprises four ports, and

the first port of the first wavelength managing module with self-loops is connected to the first port of the high-isolated wavelength managing module,

the first port of the second wavelength managing module with self-loops is connected to the fourth port of the high-isolated wavelength managing module,

20 the second port of the wavelength managing module without self-loops is connected to the second port of the high-isolated wavelength managing module, and

the third port of the wavelength managing module without self-loops is connected to the third port of the high-isolated wavelength managing module.

32. The high-isolated wavelength managing module of claim 31, wherein the first

port of the wavelength managing module without self-loops is connected to the second port of the first wavelength managing module with self-loops, and the fourth port of the wavelength managing module without self-loops is connected to the third port of the second wavelength managing module with self-loops.

- 5 33. The high-isolated wavelength managing module of claim 32, wherein the third and the fourth ports of the first wavelength managing module with self-loops are connected to form a self-loop, and the second and the fourth ports of the second wavelength managing module with self-loops are connected to form a self-loop.

- 10 34. The high-isolated wavelength managing module of claim 33, wherein the self-loops are connected by optical fibers.

35. The high-isolated wavelength managing module of claim 29, further comprising an optical function module coupled between the second and the third ports of wavelength managing module without self-loops to form a high-isolated bi-directional optical function module.

- 15 36. The high-isolated wavelength managing module of claim 35, wherein the optical function module comprises an optical gain module.

37. The high-isolated wavelength managing module of claim 35, wherein the optical function module comprises an optical add-drop module.